- **Convolution**: $(f*g)(t)=\int_{-\infty}^{\infty} f(\tau)g(t-\tau)d\tau$
  - Key property: $\mathcal{L}\left[(f*g)(t)\right]=F(s)G(s)$
  - $(g*f)(t)=(f*g)(t)$ Convolution is commutative
    - Implies $\int_{-\infty}^{\infty} f(\tau)g(t-\tau)d\tau=\int_{-\infty}^{\infty} f(t-\tau)g(\tau)d\tau$
  - Proof of this formula using a double integral and a change of variables with a Jacobian determinant
- Convolution on a finite range [0, *t*]:
  - $(f*g)(t)=\int_{0}^{t} f(\tau)g(t-\tau)d\tau$
- Meaning of convolution: Convolution is the amount of overlap of *g* as it is shifted through another function *f*.
- Applications
  - Signals (audio/visual) processing and filtering
  - Probability distribution of two independent variables
  - Mixing problems
  - Radioactive dumping/decay
    - The amount of radioactive material is the convolution of a dumping function and the decay function